IMAGE FEATURE EXTRACTION AND ENHANCEMENT USING SOFT COMPUTING TECHNIQUES

For Degree of Philosophy in Computer Science
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Synopsis
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1. **Introduction :**

The glory of Artificial Intelligence is enhanced with the capacity to identify the objects with great deal of accuracy. These algorithms are not only known for the accuracy, but also the ability to learn. The word 'Computer Vision' becomes the glorified word in the field of research. Its capacity to acquiring, analyzing and understanding the digital image mimics the way human vision works, may be with little added accuracy [1]. But in spite of all its name and fame there are still few challenges that one has to tackle like the angel of the face at the time of shoot. If the angel changes the same person might look different. If the image is overlapped/ occluded with some other objects, the difficulties are increased. If the images are dissolved in the background or the light used for the image capturing etc. all these real world challenges make the things little not so easy category.

Another point of concern may be how to deal with the blurred images. Till the time one could identify the image is blurred, one might missed the incident to reshoot it. There are multiple types of blur like blur by motion, blur by out of focus, average blur or Gaussian blur etc. But it is also possible that the blur may be caused due to more than one type or reason. So it is a problem of edge detection, but whether the deep learning methods can detect the different of blurring and can also apply DE blurring methods to get the fine images.

Each of the object detection method focuses on different way to extract the features in the images. Once the feature engineering is done, one has to apply different algorithms for the various tasks involved like

recognition, prediction etc. Various methods had already proved their usefulness in various different domains. But when it is time to choose the best method, one has to compare and decide which might be the best technique that could solve the problem in a hand. The urge in human being takes him for different experimentation, expects to find out new methods to get the best answer. Sometimes it is even needed to opt out for some hybrid solution where more than one methods can be employed in a hope to get better accuracy.

2. Review of Literatures:

i) The paper entitled A Novel Feature Extraction Descriptor for Face Recognition researcher A. B. S. Salamh [2] and H. I. Akyüz presents a new feature extraction technique for face recognition. The new model, called multi-descriptor, is based on the well-known method of local binary patterns. The combination of multi-descriptor and SVM is used to build this model.

ii) The Researcher, Y. Said [3], M. Barr, and H. E. Ahmed in research paper entitled "Design of a Face Recognition System based on Convolutional Neural Network (CNN)", has used various technique for image feature extraction and recognition. They used Convolutional Neural Networks (CNNs); artificial intelligence and other deep learning techniques.

iii) Bagchi, Parama[4] in the thesis entitled "Registration of Point clouds for Human Face Recognition" year 2020, aims to establish the importance of registration in 3D face recognition area. Various approaches for face registration have been implemented, and shown in what manner recognition performance improves or degrades after registration. The researcher used standard feature extraction techniques like PCA,

LBP, DCT, Gabor filters, and then these were classified using Multilayer Perceptron.

iv) In the paper entitled “Convolutional Neural Network for Face Recognition with Pose and Illumination Variation” researcher A. R. Syafeeza [5] has used a robust 4-layer Convolutional Neural Network (CNN) architecture is proposed for the face recognition problem. Experimental results show that the proposed CNN solution outperforms existing works, achieving 99.5% recognition accuracy on AR database. The test on the 35-subjects of FERET database achieves an accuracy of 85.13%, which is in the similar range of performance as the best result of previous works.

v) In the thesis named ‘Image enhancement effect on the performance of convolutional neural networks’ X. chen [6] explored the effect of image enhancement algorithms on the performance of CNN models in deep learning and transfer learning, respectively. The article selected five different image enhancement algorithms, they are the contrast limited adaptive histogram equalization (CLAHE), and the successive means of the quantization transform (SMQT), the adaptive gamma correction, the wavelet transform, and the Laplace operator.

vi) Athanasios Voulodimos [7] in research paper entitled as "Deep Learning for Computer Vision: A Brief Review" has done comparative study of different deep learning algorithm viz. Convolutional Neural Networks, Deep Belief Networks and Deep Boltzmann Machines, and Stacked Auto encoder for computer vision. The researchers conclude that every algorithm has its strength and weakness so need to select correct algorithm at every stage of Computer vision

3. Objectives of Research:

The objective of the research basically focuses on the study of different deep learning techniques for the identification and enhancement of the image. Following are some of the objectives of the research work:

- To obscure complex information from a given image dataset.
- To study various technologies available for object detection, recognition and enhancement.
- To design, develop a hybrid model using combination of more than one techniques.
- To verify and evaluate the model using a case study approach.
- To extract features of the image using different feature extraction methods.
- To compare the performance of the model by tuning different parameters with different features.

4. Methodology to be adopted:

The proposed research is a study to answer the question framed i.e. how to recognize the object more accurately? To address this question, researcher has planned a twofold approach. The first approach is to test the proposed model using standard data set and then the validated model has to be tested on a dataset which has to be generated manually.

To generate a new dataset, one has to think about the different pre-processing techniques to make the data of same dimension. The data has to be normalized, scaled and if required may be needed to transform it into grayscale. To tag and annotate the data, feature extraction, feature selection etc. a series of different operations has to be performed under the heading of preprocessing.

Next thing would be to design a model that suits need of our hypothesis. Here one has to do a comparative study of different algorithms available for the recognition and then experiment to check whether more than one techniques can be combined to get a better efficiency or accuracy. But there are several approaches to that like selecting the feature vector. Here it would be very interesting to see that which particular technique would be better to get the exact feature map. The alternative could be the model building and feature engineering can be done by two separate techniques.

In all two different sets of experiment has to be performed with keeping 70% data for training, 20 % data for testing and 10 % of the data reserved for validation. Once the model is ready, it is compared for two different datasets. The results are recorded and performance is evaluated by tuning different parameters. It is for sure that every algorithm is different and has its own set of advantage and disadvantages, so one has to apply different setting to get the optimal result.

Another interesting part would be to investigate the influence of different environment factors on the performance of the model. Like light, angle, the number of objects overlapped etc. and accordingly the model has to be re-tuned.

5. Importance of study:

i) International status:

From the last few years, the Digital Image Processing is keep changing over the time. The role of Artificial Intelligence has dramatically changed the way the digital image processing works. The research area called computer vision is now a hot cake, due to the wide range of applications in multiple domains. With the

advancement of technology, the ease in getting the computing resources like fast processors, GPU, RAM has changed the way the computing takes place. The amount of data it can handle, the time required for processing the data everything in now under control. So, it would be interesting to see how the traditional methods can be utilized to take the advantage of the changed scenario.

ii) **Significance of the study:**

Although a lot of research has been already done in the field of computer vision still there are new horizons which expects researchers to revise the techniques in hope of getting better accuracy.

The contribution of this research could be put in words like:

- Its specialty in using various different methods to form a hybrid model that could give a high degree of accuracy in field of computer vision.
- Its ability to set the benchmark, this research will be using a standard dataset available on the internet. So the same could be compared with the new data generated by the researcher.
- It also has the ability to deal with partial or incomplete data. This can accept vagueness in the data.
- It can extract different features from the image data and can analyze the complex features to understand the image in better sense.

So one can see there is still scope for contribution in this area.

6. Proposed work Plan:

Year-wise Plan of work and targets to be achieved:

I. 15th July 2021-15th July 2022:

- Collection of Research Papers
- Complete Course Work.
- Study of Python with necessary libraries like Pandas, Scikit learn, TensorFlow, Keras etc. and Others Software/Tools.
- Attending International/ National/ State Conferences & Published One or Two Research Papers.

II. **15th July 2022-15th July 2023:**

- To perform different pre-processing operations on standard datasets in order to understand the data.
- Manually new image dataset has to be created.
- To study different features of image.
- Two research papers published in International Conferences.

III. **15th July 2023-15th July 2024:**

- To study different deep learning techniques.
- Feature extraction techniques implemented in Python / MATLAB/Tools software.
- Proposed model for object Identification & Recognition algorithms is developed using deep learning techniques.
- Test developed algorithms in different circumstances.
- Two or More research papers published in UGC referred Journals.

7. References

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